



PIER Energy-Related Environmental Research

Environmental Impacts of Energy Generation, Distribution and Use

Testing and Improvement of the ORCM Chinook Salmon Model

Contract #: WA 500-02-004 UC MR-035-03

Contractor: Oak Ridge National Laboratory

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Match Funding: None

Contractor Project Manager: Dr. Henriette I. Jager

Commission Project Manager: Gina Barkalow

Commission Contract Manager: Mike Magaletti

The Issue

Various models have been developed to predict the effects of hydropower operations on fish populations. Hydropower generators and resource management agencies in California have recently expressed interest in applying the Oak Ridge Chinook Model (ORCM) to better understand how their decisions about seasonal and annual patterns in river flow will influence salmon production. In addition, the financial problems and energy deficits experienced by California during the late 1990s highlight the importance of understanding the other side of the equation—the loss of energy capacity associated with regulated flows. This project seeks to develop a better-tested quantitative tool for those making decisions about California's aquatic and energy resources.

Project Description

The goal of this project is to test and improve an existing population model for Chinook salmon (*Oncorhynchus tshawytscha*), the ORCM. We will compare the model's predictions of year-to-year differences in the production of juvenile salmon, as well as its predictions of the timing of outmigration in the spring, against historic field data collected by the California Department of Fish and Game for the Tuolumne River since 1995. If this comparison highlights inadequacies

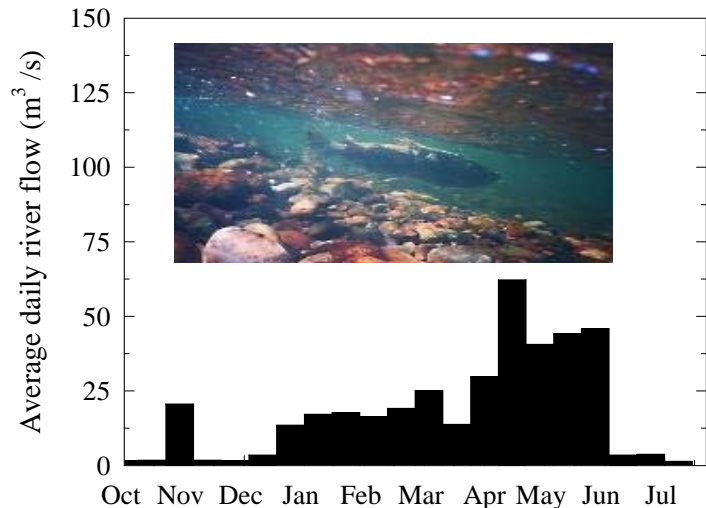


Figure 1. ORCM-predicted seasonal flow regime to maximize production of Chinook salmon outmigrants with total annual flow constrained less than or equal to 489 hm³ (489 million cubic meters or 400,000 total acre feet)

that can be rectified by adjusting parameter values or altering the way processes are represented, we will revise the model accordingly.

A second task will be to add the capability to estimate hydropower generation in ORCM. This feature will make it possible to evaluate tradeoffs between the water flows necessary for salmon production and hydropower generation.

PIER Program Objectives and Anticipated Benefits for California

This project offers numerous benefits and meets the following PIER program objectives:

- **Providing environmentally sound energy.** This research will allow hydropower operators to quantify the expected increase in Chinook salmon produced from rivers and the expected loss of hydropower generation associated with flow adjustments. The ORCM has already been used to predict optimal salmon-friendly patterns of seasonal flow (Figure 1). This work will reduce uncertainty in the model's predictions of salmon production, thereby enabling improved decision making in scheduling environmental flows.
- **Providing reliable energy.** This project will incorporate the value of power generation into the ORCM, thereby enabling the model to better optimize the balance between salmon production and energy production.

Final Report

PIER-EA staff intend to post the final report on the Energy Commission website in spring 2006 and will list the website link here.

Contact

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